DOCUMENT RESUME

ED 248 724 FL 014 580

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TITLE Computer Simulation and ESL Reading.
PUB DATE Jul 84
NOTE 22p.; Paper presented at the Summer Meeting of Teachers of English to Speakers of other Languages (6th, Corvallis, OR, July 13-14, 1984).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Advanced Courses; Classroom Techniques; *Communicative Competence (Languages); *Computer Oriented Programs; Educational Research; Educational Theories; *English (Second Language); Higher Education; *Reading Instruction; *Second Language Instruction; *Simulation
IDENTIFIERS Portland State University OR

ABSTRACT

It is noted that although two approaches to second language instruction--the communicative approach emphasizing genuine language use and computer assisted instruction--have come together in the form of some lower level reading instruction materials for English as a second language (ESL), advanced level ESL reading materials using computer simulation and games are not yet available. The structures of traditional foreign language simulations and of computer simulations are outlined and compared, and a model for computerized foreign language simulation is outlined. One simulation program currently used to teach elementary school students basic geological concepts is described. Three short-term classroom-centered studies of computer simulation in upper-intermediate and advanced level ESL at Portland State University are then described and their results are discussed. It is concluded that although no definitive claim can be made, computer simulation does increase active involvement in reading for understanding, is integrative and flexible, requires extra time, and should be stopped when goals are achieved and be followed immediately by followup feedback and exercises. (MSE)

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Computer Simulation and ESL Reading

Mary A. Wu
July 1984

Introduction

About a year ago, David Wyatt pointed out in the TESOL Newsletter that "Computer-assisted learning techniques are likely to have a major impact on the teaching of reading" (Wyatt, 1983:9). Today, we are going to discuss the use of computer simulation in advanced college-level ESL reading in light of current theories and practice in ESL and CAI. We will also look at three short-term classroom-centered studies of computer simulation in advanced college-level ESL reading classes and make suggestions for computer simulation and ESL reading at this level.

The Communicative Approach

As pointed out by Widdowson in Teaching Language as Communication, "The 'communicative' approach is, of course, very much in vogue at present" (Widdowson, 1978:ix). The core of this approach is genuine language use. Widdowson makes some fine distinctions between such terms as usage and use, signification and value, cohesion and coherence, and so on. Usage demonstrates knowledge of linguistic rules, while use relates to the ability to use these rules to communicate effectively; signification refers to meaning from syntax and semantics, while value includes illocutionary acts as well. It is the same with other items down the line, which also may be categorized as either usage or use. The Communicative approach aims at language use and emphasizes authentisity in the language classroom. It stresses the use of integrated language skills, problem solving and games, focuses on process rather than item, and brings content areas on the school curriculum into the language classroom. Some examples of these trends might be Widdowson's suggestion of using information transfer, simple accounts and gradual approximation to build reading skills; textbook content on various subject matters as seen in Reading

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by All Means, Readers' Choice, and so on; and the rapid development of ESP and EST.

CAI, CALL

Alongside with these developments, there is also CAI (Computer Assisted Instruction) or CALL (Computer Assisted Language Learning), which shows the impact of the information revolution on language learning today. Drill and Practice and Tutorial are the most commonly used modes of CAI. Though they have specific features that are very much welcomed, e.g., branching and immediate feedback, and they are interactive to some extent, in terms of the communicative theory, they are still categories of language usage rather than real language use (Fig. 1). Dialogue is more open-ended. It is used in English classes to teach literature and composition but has not quite made its way into ESL yet. Simulation is widely used in all disciplines and is used somehow in ESL too. It is integrative in nature and ideal for language use. Games fall into this category, too.

Usage	Use
Signification	Value
Cohesion	Coherence
Drill & Practice	Computer Simulation
Tutorial	Games

Figure 1. Categories of Usage and Use.

At present, in CAI and ESL reading, we have Drill and Practice and Tutorial for grammar, vocabulary, reading comprehension, including reading for main ideas, structural patterns, and specific facts and details. We also have a few simulations and games for lower level reading skills, as presented by John Higgins at an international conference in London in December 1981. However, simulations for developing higher level reading skills in ESL are still not available at this point.

Simulation

What is a computer simulation? Let's start with regular simulations. In 1977, Kerr et al. pointed out in "Games, Simulations and Role-Playing" that "Communication games and simulations have now acquired a new respectability in the field of foreign language learning," because 1, they insure purposeful communication; and 2, they provide an excellent opportunity to integrate language skills, materials and practice; furthermore, they are interesting and relevant to learners' needs and therefore motivating (ED 148176, 1977).

A simulation is governed more by information and data than by rules. It usually follows a set of procedures or goes through certain stages and it always has a clearly defined goal (Kerr, 1977). The following chart by Sturtridge gives a fairly good idea of the structure of a simulation (Fig. 2).

Phase I is the preparation phase, which presents the task and information, including linguistic information as well. Phase II is discussion and solving the problem. Phase III is feedback. The structure allows controlled, purposeful practice with a great deal of flexibility to meet different instructional and learning needs. For instance, as we are interested in reading skills development, in phase I we can have the students do a lot of skimming and scanning, including reading maps and graphs, for information and references. In phase II, more reading can be integrated. Phase III usually is tape-recording play back and feedback, which Sturtridge regards as most important but also most difficult to handle. Special skill and care is needed so as not to overwhelm the students with their errors after they have just enjoyed communicating with some success in phase I and phase II. For best results, Sturtridge also recommends simulations at regular intervals (Sturtridge, 1977:13).

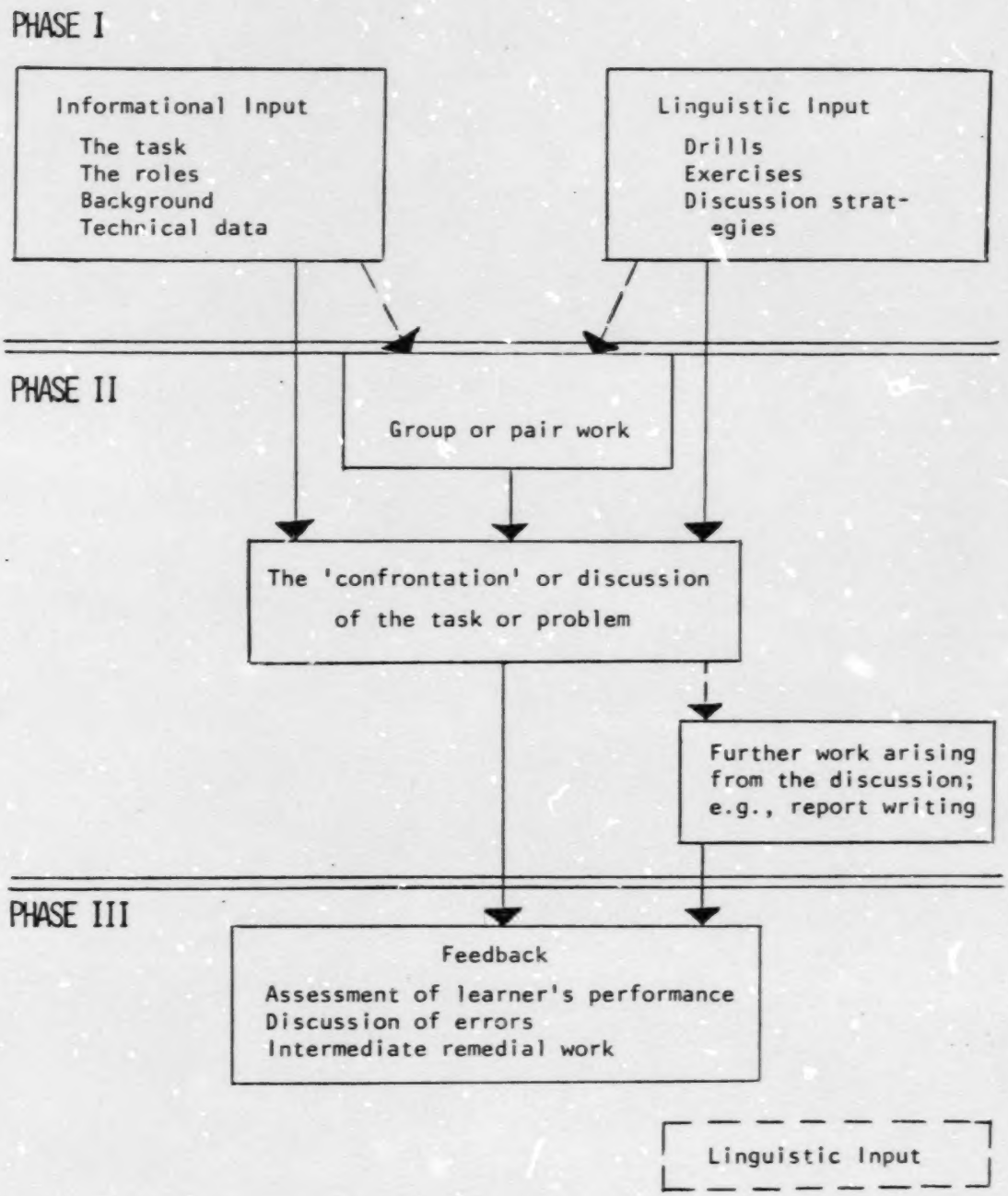


FIG. 2 THE STRUCTURE OF A SIMULATION (Borrowed from Gill Sturtridge, ED 148176)

In summary, as suggested by Sturtridge,

> Simulations should not be regarded merely as a "fun" activity but as a structure that can carry materials which integrate listening, reading, writing and oral skills; they provide the learner with an opportunity to summon up and use all the language he has, which will extend far beyond what he has been "taught" (Sturtridge, 1977:13).

Computer Simulation

Computer simulation, on the other hand, is new to the language class though it has been a popular means in a wide variety of fields since the 1960s. As pointed out by Bonham-Carter and Harbaugh, a computer simulation consists of three basic steps: the definition of a system; the construction of a model, and the use of the model to imitate the behavior of the system (Bonham-Carter, 1968:3)(Fig. 3).

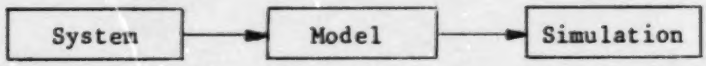


Figure 3. Three basic steps necessary for simulation of any process or collection of processes (Bonham-Carter, 1968:3).

In step 1 we look at the real world, collect data and information and figure out the relationship between the variables. Based on step 1, in step 2 we construct the Model, which usually stores and presents data on a discrete-state, continuous-time basis. And in step 3, we operate on the Model to test plans, theories and hypotheses. As it is often much more economical to test system designs and hypotheses on a computer than to try everything out in real life situations, comupter simulation has become an exceedingly important tool for decision making and has entered the classroom as a tool for instruction as well (Bonham-Carter, 1968:3-7). According to literature on computer simulations, simulations of real systems provide learning opportunities that are otherwise impossible because of cost, time, danger, or other reasons. They intend to present problems that are "richer, more real, more encompassing, and

certainly more interesting" (Bardige, 1983:46). Many computer simulations focus on problem-solving while tackling the learning problems associated with them. This not only makes curricular content implicit rather than explicit (Tinker, 1983:37; Bardige, 1983:45-46), but also tests learning itself, because one usually has to understand the model and the variables quite well in order to complete the simulation successfully (Mecc, 1980:1).

What we are most interested in here is step 3, the Simulation, where we get to work on the model. Using computer simulations in the language classroom gives us the advantage of bringing in not only the content of other school subjects but also the special learning techniques used in those content areas. Challenging and fascinating problem-solving tasks naturally shift students' focus of attention from linguistic skills to authentic language use, and the game factor that is usually involved makes learning fun, thus adding favorably to the affective factors in the language class. The use of information technology adds especially to the naturalness and authenticity of the learning process, as it builds towards computer literacy in an information age.

Like regular simulations, we still have three phases (Fig. 4), but the three phases overlap somehow, as indicated by the broken lines, and there is a better integration of skills and feedback in phase II, which we now call "The Simulation." During this phase, the students will be interacting with the computer as well as with one another; they will be reading for new information, striving for a better understanding of the course content, and will be getting feedback during the whole process, not mainly from the teacher but from doing the job. To illustrate these points, let's have a brief look at Geology Search and the three studies conducted at Portland State University.

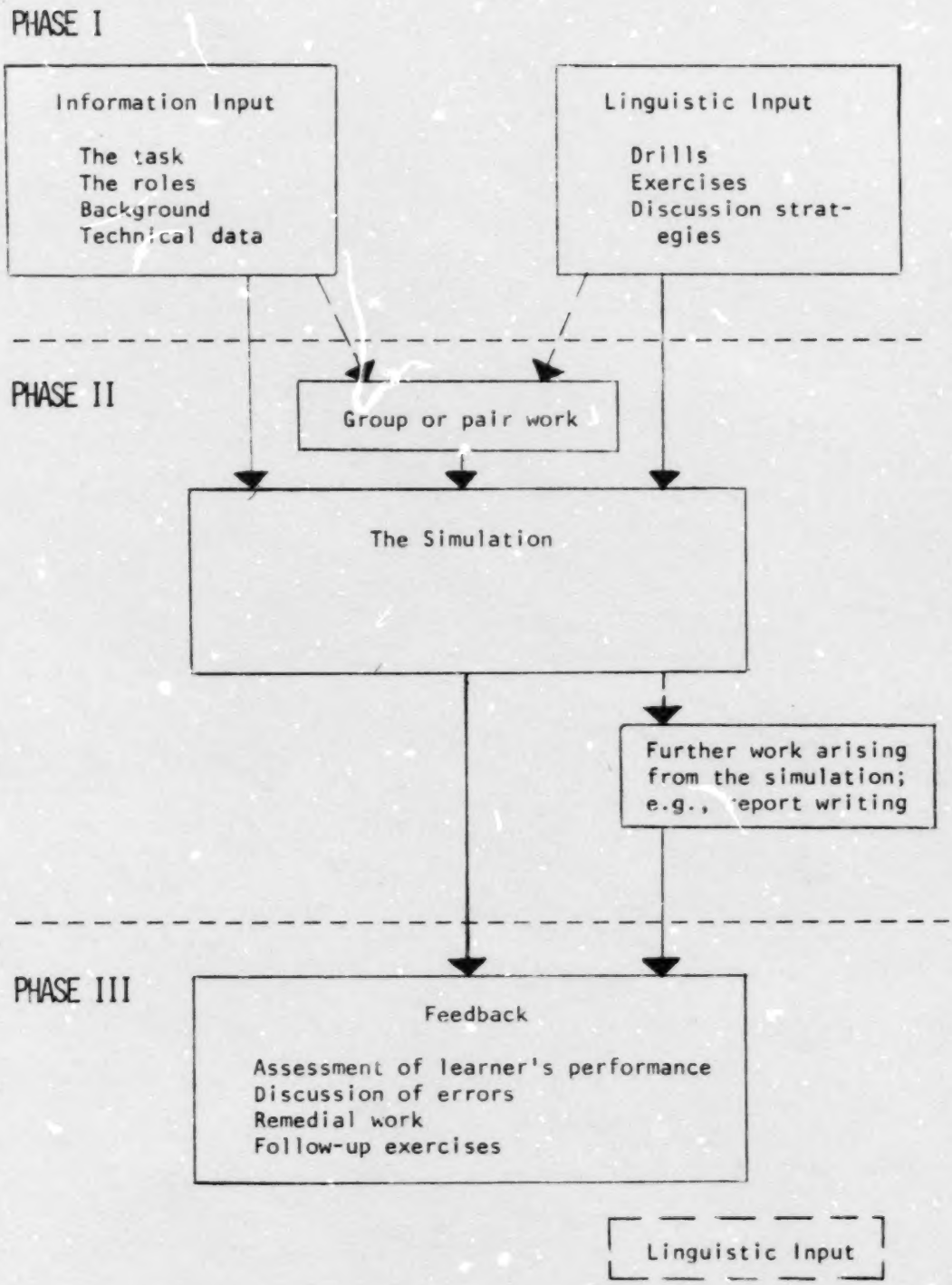


FIG. 4 THE STRUCTURE OF A COMPUTER SIMULATION IN THE LANGUAGE CLASS

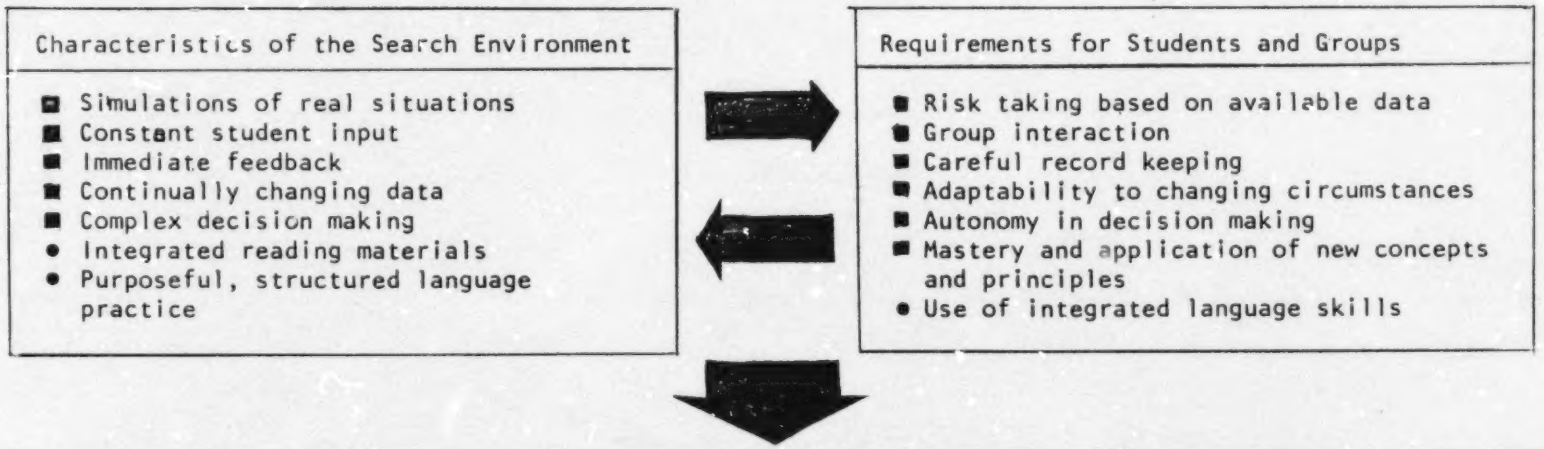
Geology Search

Geology Search is a computer simulation designed by Thomas Snyder to teach 6-Grade native speakers basic geological concepts and knowledge of oil exploration. It is also the courseware used in the three studies at Portland State. The Search courseware consists of a Teacher's Manual, a Searchbook, and the Computer Program, which is on a floppy disc.

The Teacher's Manual introduces the simulation, explains its strategies and objectives, and gives instructions and suggestions for using the Search. The chart in Fig. 5 developed from Snyder's Search series gives an overall picture of the learning strategy and expected outcome. The dots indicate features added when used for language instruction in ESL. As stated in the Teacher's Manual, capabilities of the microcomputer are utilized here to "build on and complement traditional, time-tested modes of teaching and learning" (Snyder, 1982:4), and the learning of language skills becomes less explicit as it is well contextualized and integrated in the simulation.

The Searchbook is designed to work with the simulation. It contains the text, search words, search questions, directions, maps, charts, and graphs to fill out during the simulation. The content, vocabulary and syntax are science oriented yet not highly technical and the text is what Widdowson would call a SIMPLE ACCOUNT (1978:89). It has 7 Chapters, over 4,200 words of text, covering "New Discoveries on an Old Continent," "Two Kinds of Rock," "The Density Scan," "Core Sampling," "Seismic Blasts," "Drilling," "Selling Your Oil," and "Welcome," which serves as the preface to the reading. Unlike traditional geology and EST texts, Geology Search tells the story of Drillco scientists' search for oil in Newlandia. Students then become natural resource explorers themselves. They use Drillco as an example and apply what they have learned

Fig. 5 THE SEARCH LEARNING STRATEGY



This is developed from Snyder's Search series.

from the reading to their own oil search. After reading the Searchbook, and probably also after some discussion, the students are ready for the simulation. This is where Geology Search goes beyond traditional teaching and learning.

The class is divided into small groups, ideally 4-5 students each. Each group chooses their own company name and types it into the microcomputer, which then keeps track of the activities. There is only one computer, and the companies take turns working on it. Brief directions appear on the screen, and when the company has given its instructions, the computer will carry them out and present test results, which might show as charts, graphics or numbers, or short statements as well. Within 6-16 seconds, the computer clears the screen, gives a short report, and it is the next company's turn. Following is a sample run of the Density Scan (Fig. 6-9):

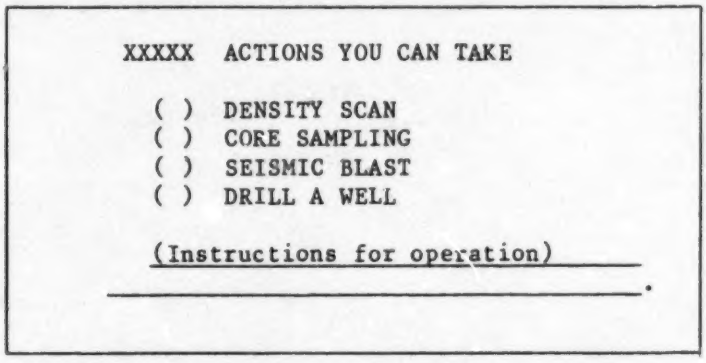


Figure 6. Step 1 of Density Scan

Students come up to the computer when their company name occurs on the upper left hand corner of the screen. They read the instructions, move the cursor to their choice with the space bar and hit RETURN to continue.

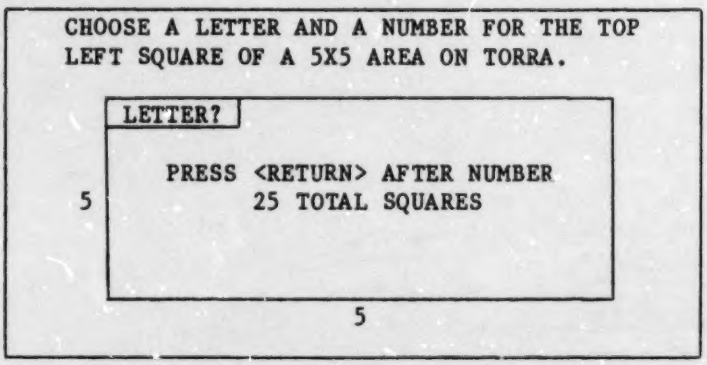


Figure 7. Step 2 of Density Scan

Students read the instructions on the screen asking for a letter and a number for the test site, which they decide upon through reading and working with the map. They type the letter and the number and hit RETURN to continue.

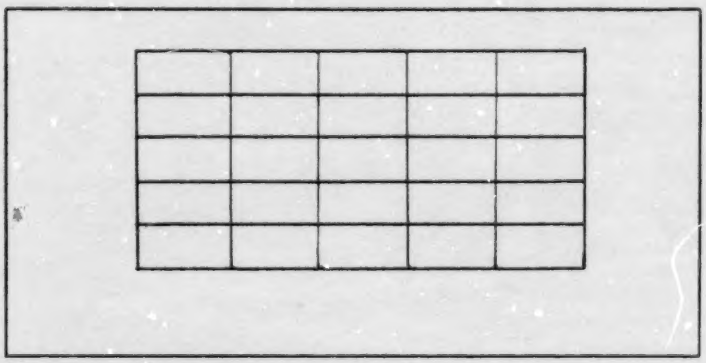


Figure 8. Step 3 of Density Scan

The computer displays test results. Starting from the upper left hand corner, from left to rignt, top to bottom, it fills the grid within 11 seconds, presents the average density underneath the grid, holds for another 4 seconds, and clears the screen.

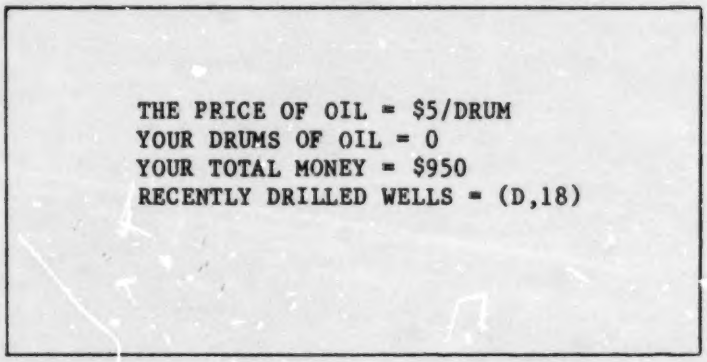


Figure 9. Step 4 of Density Scan

The computer reports information changes according to market situation and how the companies are doing. Within 6 seconds it clears the screen and it is the next company's turn.

During the simulation, when RETURN is required, as in Steps 1 and 2, students have control over the situation and can take time in reading instructions and giving commands. When there is no RETURN required, as in Steps 3 and 4, the computer has control over the speed, which keeps the task more challenging.

After the company had its turn, the students go back to their own corner and work on their own data in the company. They consult their textbooks when necessary and make decisions for their next move. The instructor may play the role of a geological consultant, but provides no answer except where to look for information. Emphasis is clearly on problem solving based on reading comprehension of the text and data on the screen. Group work is necessary, as the company members must cooperate to collect the data on the screen within a few seconds and depend on themselves in the simulation. As the computer presents no ERROR message nor suggestions, the process is non-evaluative and allows the student to learn through trial and error and make self-corrections or rather self-improvements. Feedback occurs not just in the end but through the whole process.

Since the simulation requires no special operating skills and can be stopped and continued at any point, it suits different instructional needs and serves well as an introduction to computer literacy for those who have never worked on a computer before.

In summary, Geology Search combines a simple account with special features of the computer and provides an ideal learning environment for developing reading skills. It is supposed to enhance active involvement, which is crucial in reading instruction, and to allow purposeful, structured practice and the use of integrated skills. It is also believed to help improve retention of the knowledge learned.

The Three Studies

In order to see how a computer simulation actually works out in an ESL reading class, three short-term classroom-centered studies were carried out at Portland State's ESL Center. The first study was done in Spring 1983, and the other two in Winter 1984. All were conducted in natural classroom settings with upper-intermediate and advanced level ESL college students. Since this paper does not intend to report all the details, only a brief description of the procedures is presented here before discussing the results.

The first study served as a pilot run providing tentative answers to the following questions:

How can this be taught? How do students respond?
Is the level appropriate? What kinds of problems arise?
What kinds of potential does it have for teaching what kinds of skills?
What kind of changes should be made if used again?

As the class (G1) was an upper-intermediate level practice class that had been working with TOEFL materials throughout the term, the Search took over with a similar pattern of timed reading in the beginning. After a brief introduction to the computer simulation and an overview of the text, the

students divided up into companies and were asked to use all the skills and strategies they have acquired to read and discuss in class. In the 3rd class period, the whole class worked together highlighting main points and scanning for specific information. A student also gave a speech on his own experience in Kuwait's oil fields. We started the computer simulation in the later part of the 3rd class period, went through another class period plus an extra half hour till one company hit oil. The students were then asked to hand in their company records and to fill out a questionnaire.

The overall response is positive. All were actively involved throughout the process and would like to work more on computer simulations. Except for inference-making and record-keeping, the skills we had in mind, e.g., skimming, scanning, problem-solving, following directions, non-verbal reading and information transfer, were well practiced during the search. Based on the results, adjustments were made for the other 2 groups.

First of all is the time distribution and integration of course content (Fig.10). G1 did not have enough time to complete the task, so now more time is set aside for the simulation. G2 used regular reading class time, G3, part practice class, part reading class time, and the computer simulation was integrated with regular class content, mainly reading-skills development and rhetoric, e.g., cause and effect, comparison and contrast, outlining, skimming, scanning, and inference-making. Except for the introduction and overview, reading was done at home so as to allow more time for discussion in class. There was homework for G3 and a quiz for G4. The new time arrangement also allowed more guidance and a better integration of feedback during the search.

Other differences include the instructor factor and student levels. G1 was conducted by the experimenter joined by a Graduate Teaching Assistant in the later stages. Both worked on Geology Search before. G2 and G3 were

taught by senior instructors in the program: G2 by a senior instructor alone as part of the regular course; G3 by a senior instructor and the experimenter, combining reading and practice classes as a whole. The instructors had read the materials and viewed the program, but had never worked on it before.

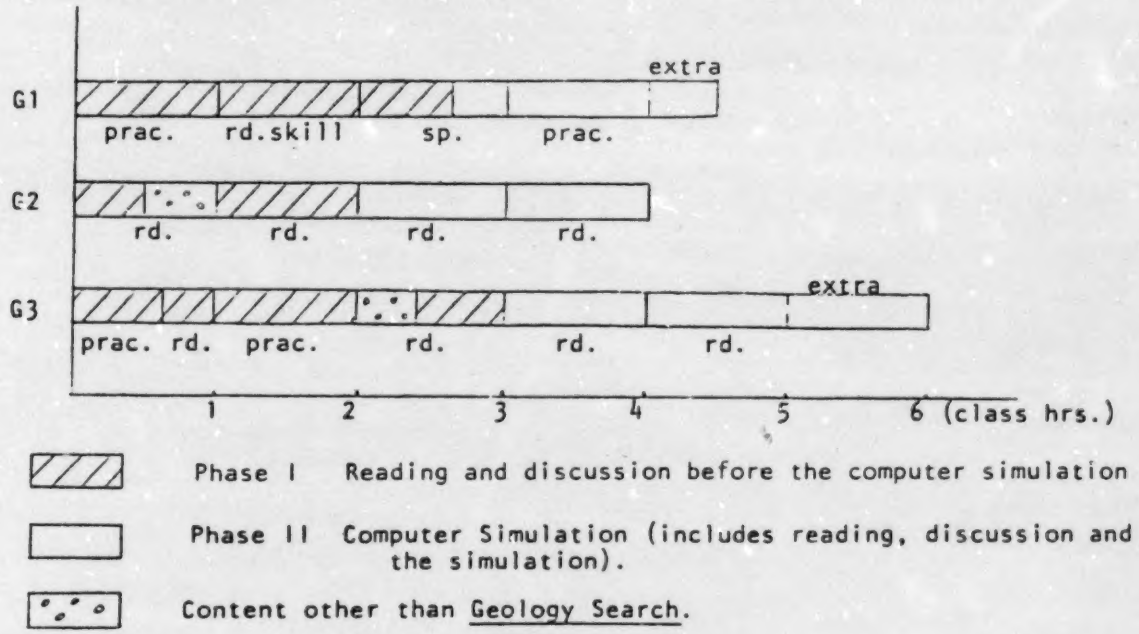


Fig. 10 Time Distribution of the Studies

Student level shows a slight difference here, too (Fig. 11).

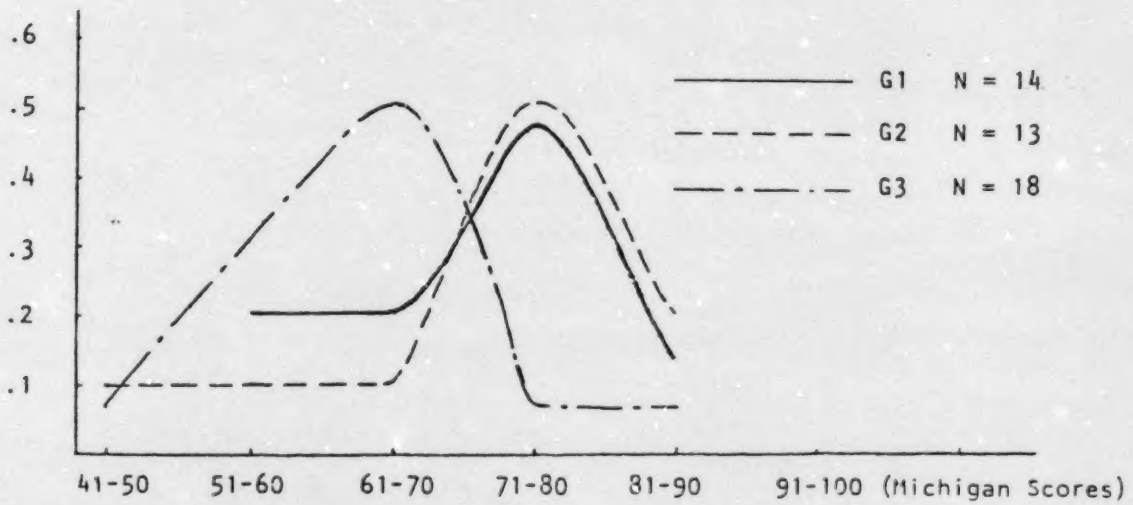


Fig. 11 Student Level (Ratio)

G2 and G3 followed similar procedures as G1, i.e., Introduction, Overview, Reading, Discussion, Simulation, Collect Company Records, and Fill Questionnaire. Results show that even though each Group had specific features of its own, the three studies did come up with some things in common that allow generalizations.

Discussion

1. Student Involvement

In terms of group behavior, only one company out of eleven had about half a minute digression throughout the whole process. It was when G2 was two-thirds into the second class period with the computer. The company just hit oil and were on their way back to their headquarters. Once they sat down, they went right back to the Search.

In terms of individuals, there were different degrees of involvement. Some were really enthusiastic and actively involved. They read reference materials on their own and brought their notes to class to share with others. Some were merely participating, not contributing much to the solutions. There were also those who do not attend class regularly and did not change just because of the simulation. However, all who attended were well occupied by the task. They arrived early, stayed overtime when possible, and interacted with one another as well as with the computer. They were busy reading their text and notes, scanning for specific information, making decisions, keeping records, coordinating their group activities, and were absorbed in the task all the way through. Considering the length of time (3-4 2/3 hrs.) students kept up such close attention to their coursework, which is usually not easily achieved in traditional reading classes, the results are positive.

2. Mastery of Content and Skills as Shown in Completion of the Task

G1: One company out of three hit oil. Besides the limitation of time, Company maps show that the two companies were having trouble with making inferences--their test sites were simply out of place.

G2: Two companies out of three hit oil. The one that failed--an Arab company--was the only company that thought they could play the game without taking the reading seriously. They blundered along, moving as they pleased. However, even these people were frequently scanning the text as they tried to interpret test results from the computer. As the simulation proceeded, they started to realize their problem and began to read the text seriously for a better understanding, though a little late for oil at this point.

G3: Four out of five companies hit oil. All made good inferences, yet one company failed as they read the map incorrectly.

Results show that reading comprehension and skills do play a crucial part in the simulation, and they are checked upon throughout the simulation by the process itself.

3. Self Assessment

Answers to the questionnaire show that 91% thought the computer simulation helped them with their English, while 9% thought it did not. Since some among the 9% checked other items indicating improvement in reading skills, the percentage of positive responses is actually higher than the figure we have. 83% thought they could now do a better job looking up information and getting main ideas; 92% thought they could do better now in processing information.

4. Attitude (student, instructor)

97% enjoyed the search, 94% would like to do more. It should be pointed out here that in the beginning, many felt puzzled as to why we were doing such

a thing that is neither like a serious lesson nor like a game, and some responded less favorably to the questionnaire because the simulation was not the kind of instruction they were used to and therefore frustrating or not considered as serious teaching and learning. It is important that we pay special attention to motivating the students and helping them with the transition to this new mode of teaching and learning.

The instructors were supportive yet a little skeptical in the beginning, not quite sure that the computer simulation would really be all that good for their reading class. When we were half an hour into Phase II, both were very pleased with the outcome and said they would like to teach the Search every term and make it an on-going thing in the ESL program. The Graduate TA and the experimenter were just as enthusiastic about the experience, which makes responses from instructors consistently positive in the study.

Conclusion

No definitive claim can be made at this point. However, even from a rather conservative point of view, we can say that:

1. The computer simulation does increase active involvement in reading for understanding.

2. The way the Search merged into different classes shows the integrative nature of the computer simultion and its flexibility to meet different instructional and learning needs. The point is not just to use it, but how. Many have pointed out that CAI works best when there is a clearly defined goal. This is true with computer simulations, too: we need to know what we want to achieve and accordingly choose the right software and methods that work best towards our goals.

3. Since students usually have a slow start (they needed at least an

hour and a half to get somewhere in their search), sufficient time should be arranged for the simulation. In order to make full use of better integration of feedback made possible by the structure, we might also want to break up the big blocks of time (See Fig. 10) and do reading, simulation, more reading and discussion, and more simulation so as to provide more guidance and have more control over student progress during the process.

4. The simulation should be stopped when the goals are achieved and, ideally, followed by exercises that build on the SIMPLE ACCOUNT through gradual approximation towards more complex reading materials and skills. As follow-up feedback and exercises relate more to curriculum design and planning and are beyond the scope of the studies, we did not do any work in this area. It is hoped that further research will be done in these areas and reports made available before long.

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